* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the input unit for moving the cursor on the screen in a personal computer etc.
[0002]
[Description of the Prior Art] There are a trackball and a mouse as an input device (a pointing device is called hereafter) to indicating equipments, such as a computer. The trackball 1 is mainly installed in the keyboard 3 of personal computer 2 grade, as shown in drawing 33 and 34, and it moves the location of the cursor on a screen according to the hand of cut and rotation when rotating a ball 4 with a finger. If the principle of operation is explained briefly, as shown in drawing 34 , the rotary encoders 7 and 8 which detect a hand of cut and an engine speed through rollers 5 and 6 are formed in the biaxial direction of the X-axis and a Y-axis to a ball 4, and the hand of cut and rotation signal of each rotary encoders 7 and 8 according to the hand of cut of a ball 4 can be detected. This signal is changed into the electrical signal divided into X shaft orientations and Y shaft orientations at the body of a personal computer, it transmits, and the cursor location on a screen is moved according to a signal in the body side of a computer.
[0003] For example, if a ball 4 rotates to X shaft orientations, the shaft 9 of X shaft orientations will rotate and the rotor plate 11 with which two or more slits 10 were formed will rotate. In 2 sets of LED12 and the photo detector 13 which were allotted on both sides of the rotor plate 11, light of LED12 is made a pulse signal by the slit 10, and is changed into an electrical signal by the photo detector 13. Since the hand of cut and engine speed of a rotor plate 11 are detected by this and it shows the rotation of the ball 4 of X shaft orientations, the cursor location on a screen is moved in the direction corresponding to X shaft orientations according to a rotation. Moreover, if the hand of cut of a ball 4 is a 45-degree direction to the X-axis and a Y-axis, since the rotation signal of a hand of cut and tales doses will be acquired by coincidence from the rotary encoders 7 and 8 of the X-axis and a Y-axis, according to the signal of each shaft orientations, a cursor location is moved aslant.
[0004] Moreover, about a mouse 15, by carrying out drawing 35 and a configuration as shown in 36, installing a trackball 1 and the same ball 16 in an inferior surface of tongue, and moving the actuation plate 17 or a table all around, the cursor on a screen moves according to this motion, and alter operation is performed by pushing the click carbon button 18 further. In addition, the internal structure is almost equivalent to a trackball 1.
[0005]
[Problem(s) to be Solved by the Invention] In the above-mentioned trackball, there is a possibility that malfunction by invasion of the surroundings or dust which needs a mechanical operation part since it accumulates may occur. Moreover, the tooth space which arranges the trackball itself is needed, and there is a difficulty that it cannot respond to space-saving-ization.
[0006] Moreover, a mouse also has the same problem as a trackball, and also the flat surface to which a mouse is moved is needed, and there is a difficulty that it cannot be used for a portable small personal

computer. In addition, although there are some which use a light emitting device and a photo detector as an optical mouse, and detect the movement magnitude of the X-axis and Y shaft orientations instead of such a mechanical mouse, the special actuation plate of dedication is needed instead of there being no mechanical operation section, and it cannot still respond to space-saving-ization.

[0007] Then, it considers as the pointing device which made the actuation tooth space smaller than a trackball and a mouse further, and there is a pointing stick arranged between the keys in a keyboard. Since this is the thing of a contact method which used the contact or the distortion sensor, a difficulty is in dependability or endurance and high-reliability and a non-contact method of high endurance are desired in the pointing device with much operating frequency. Moreover, the configuration of a latter input process becomes complicated and there is a difficulty also from the field of cost.

[0008] Then, this invention aims at offer of the input unit of the high-reliability and the non-contact method of high endurance which have operability equivalent to a mouse etc. and can respond to space-saving-ization in view of the above.

[0009]

[Means for Solving the Problem] The technical-problem solution means by this invention is equipped with the photo detector 22 which receives the image of the light from the movable object 20 displaced by the load of the two-dimensional direction, a light emitting device 21, and the light emitting device 21 which interlocks and moves to the variation rate of the movable object 20 in one like drawing 1 . And the movable object 20 consists of tubed moving part 26 which displaces by artificial actuation, and a fixed part 27 for attaching moving part 26 in the devices 23, such as a computer, the interior of the detection object which made the light emitting device 21, the photo detector 22, and the lens 28 for image formation in one is carried out to moving part 26, a fixed part 27 is equipped, the photo detector 22 of moving part 26 and the field which counters are made into a reflector 36, and surface treatment is performed. Moreover, a fixed part 27 and moving part 26 change an ingredient or the quality of the material, and are fabricating it combining the degree of hardness and elasticity to need. In addition, either a light emitting device 21 or the photo detector 22 is formed in the movable object 20, the movable object 20 may be countered and another side may be prepared.

[0010] And like drawing 5 , the movable object 20 is installed in the space surrounded by two or more keys 25 of the body 24 of a keyboard, or a palm etc. considers as operational size like drawing 32 , the movable object 20 dissociates from devices, such as a computer, and is arranged, and the control means 52 to which the migration direction and passing speed of cursor 51 of a display 50, such as a computer, are changed according to the variation rate of the movable object 20 is established.

[0011]

[Function] In the above-mentioned technical-problem solution means, it is detected by operating moving part 26 and carrying out a variation rate with the detection object with which the variation rate consists of a light emitting device 21 and a photo detector 22. That is, a photo detector 22 detects a motion of the image of the light from the light emitting device 21 interlocked with the displaced movable object 20, the direction of a load is replaced in each biaxial direction which intersects perpendicularly mutually, the vector of the output of each shaft orientations is searched for, and the actuation direction and a control input are calculated from the synthetic vector. Based on this, migration of the cursor 51 according to actuation of the movable object 20 is realizable by deciding the migration direction and passing speed of cursor 51 of a display 50.

[0012] It becomes detectable by the non-contact optical method, and high-reliability and high endurance are acquired by this. And by arranging between each key of a keyboard, the pointing device corresponding to space-saving-izing can be offered. Moreover, since it is not necessary to move a flat-surface top like a mouse while operability equivalent to a mouse is acquired by dissociating from devices, such as a computer, and arranging as operational size by a palm etc., it can respond also to space-saving-ization.

[0013]

[Example]

(The first example) Like drawing 1 -4, the pointing device of this example is equipped with the photo

detector 22 which receives the image of the light from the movable object 20 displaced by the load of the two-dimensional direction, a light emitting device 21, and the light emitting device 21 which interlocks and moves to the variation rate of the movable object 20 in one, is made into a plane view T typeface in a convex configuration, and has a dimension (unit: mm) as shown in drawing 3 . And as shown in drawing 5 and 6, it is arranged in the condition of having projected from the top face of a key 25 about 1mm to the space surrounded by each key 25 of G, B, and H of the body 24 of a keyboard of the devices 23, such as a personal computer and a word processor.

[0014] Said good dynamic body 20 consists of moving part 26 which displaces by artificial actuation, and a fixed part 27 for attaching moving part 26 in the body 24 of a keyboard, and has integral construction. And the fixed part 27 is equipped with the tilt sensor of the reflective mold as a detection object which made the light emitting device 21, the photo detector 22, and the lens 28 for image formation in one so that moving part 26 may be countered.

[0015] Moving part 26 is formed in the shape of [by which the top face was blockaded] a cylinder, and the bottom serves as the foot 30 jutted out over the longitudinal direction (X shaft orientations). A fixed part 27 is made into the shape of T character, the depression 31 for equipping the inferior-surface-of-tongue side with a tilt sensor is formed, the foot 30 of moving part 26 is arranged on the top face of X shaft orientations, and the substrate 32 which performs electrical installation with the exterior is attached in the inferior surface of tongue of Y shaft orientations. And it is fixed to the body 24 of a keyboard by forming through tubes 33a and 33b, respectively, ****ing to through tubes 33a and 33b, and inserting 34 in the foot 30 and fixed part 27 of moving part 26.

[0016] And since the movable object 20 needs to produce a variation rate or deflection, a fixed part 27 is fabricated by rigid resin, and moving part 26 is fabricated by elastic resin. As rigid resin, plastics with a thermoplastic degrees of hardness of 98 or more (based on JIS K6301 test method) and a bending modulus of elasticity of 2000kg/cm2 or more (based on ASTM D790 test method), for example, PC (polycarbonate) and ABS (acrylonitrile styrene butadiene rubber), Denaturation PPO (denaturation polyphenylene oxide), etc. are mainly used. Moreover, as elastic resin, the resin of plastics with a thermoplastic degrees of hardness [70-98 (based on JIS K6301 test method)] and a bending elastic modulus of 100-2000kg/cm2 (based on ASTM D790 test method), for example, a polyester elastomer, urethane, or a rubber system etc. is mainly used.

[0017] And let a fixed part 27 and moving part 26 be integral construction with shaping by 2 color shaping from the point of precision and endurance. Moreover, in respect of the problem of metal mold structure, or total cost, insert molding is sufficient and the approach by the stop and the hook stop may be [it may **** and] used. Thus, if the movable object 20 is made into the two-layer structure of ****, the variation rate of the movable object 20 can be smoothly carried out to a load, and it will lead to the improvement in the engine performance as a pointing device.

[0018] At this time, the tilt sensor of moving part 26 and the inferior surface of tongue of the abbreviation phi5mm ceiling part 35 which counters are made into a reflector 36 for the include-angle detection by the tilt sensor which used the specular reflection of light as shown in drawing 7 (a). That is, a reflector 36 is fabricated by the flat surface and mirror plane finishing, plating processing, or vacuum evaporationo processing is performed. Moreover, as other approaches, as shown in drawing 7 (b), a plate 37 is formed in the ceiling part 35 of moving part 26 in one by 2 color shaping or insert molding by the resin or other rigid resin used for the fixed part 27, and it considers as a reflector 36 by performing surface treatment. There is an advantage of it being difficult to perform direct surface treatment if soft like elastic resin, but being easy to perform surface treatment since resin is hard according to this approach. Furthermore, although a reflector 36 is generally a flat surface, as shown in drawing 7 (c), in order to improve condensing to a photo detector 22 according to the variation rate of moving part 26, or the condition of deflection, it is good also as a curvature side. Thus, since the light from a light emitting device 21 can be used effectively, the output of a tilt sensor becomes large and a sharp image is moreover obtained by performing surface preparation which serves as a reflector 36, the detection property as a sensor can be raised.

[0019] The primary mold sections 40 which carried out the mold of the hyperfractionation

(quadrisection) photodiode which is LED (light emitting diode) and the photo detector 22 which are a light emitting device 21 as said tilt sensor with the epoxy resin of translucency etc., respectively are formed. The secondary mold sections 41 which furthermore carried out the mold of both the primary mold sections 40 with the epoxy resin of protection-from-light nature etc. are formed. The support saddle 43 of the shape of a cylinder of a lens 28 is constituted in one by fitting in removable in the lens frame 42 of the shape of a circular ring which arranged the lens 28 above the light emitting device 21 and the photo detector 22, and was formed in the top face of the primary mold sections 40 and the secondary mold sections 41. What is necessary is just to mix a light cut agent in resin, in case a lens 28 is fabricated in order to prevent the effect of the disturbance light to a photo detector 22. In addition, each photodiode of the quadrisection photodiode which is a photo detector 22 is arranged like drawing 8 to the X-axis and a Y-axis as A, B, C, and D, respectively.

[0020] And the projection 44 of a circular pair is formed in the top face of the secondary mold sections 41, the depression 31 of a fixed part 27 is equipped with a tilt sensor, and if it fits into the hole 45 formed in a fixed part 27 and moving part 26 in the projection 44, a tilt sensor will be contained by the movable object 20 and will serve as a pointing device of integral construction. Moreover, the lead terminal 46 of a light emitting device 21 and a photo detector 22 is connected to the substrate 32 by the flexible printed wiring board etc.

[0021] And the control means 52 which detects the variation rate of the operated movable object 20 from the output of a photo detector 22, and is outputted as the cursor 51 in the display 50 of the devices 23, such as a computer, or migration information on an icon is formed in the pointing device like drawing 9 . The analog signal processing circuit 53 which a control means 52 consists of a microcomputer or control IC, performs signal processing of the output current from a photo detector 22, and calculates the output signal of X shaft orientations and Y shaft orientations, The A/D-conversion circuit 54 which changes into digital value the analog value outputted from the analog signal processing circuit 53, It has the digital digital disposal circuit 55 which changes the output signal by which A/D conversion was carried out into the signal of migration information, such as the actuation direction and a control input, the serial interface 56 for enabling connection with the devices 23, such as a computer, and the drive circuit 57 which drives a light emitting device 21. In addition, the analog signal processing circuit 53 may be integrated on the same chip as a photo detector 22.

[0022] The analog signal processing circuit 53 consists of an electrical-potential-difference transducer 58 which carries out electrical-potential-difference conversion of the output current from a photo detector 22, the addition processing section 59 adding the output voltage of 2 sets of predetermined photodiodes A, B, C, and D, and the subtraction processing section 60 which calculates the output of X shaft orientations and Y shaft orientations from the added output voltage like drawing 10 . In addition, the electrical-potential-difference transducer 58 has the operational amplifier 61 and resistance R1 corresponding to each photodiodes A, B, C, and D, the addition processing section 59 has four operational amplifiers 62 and resistance R2, and the subtraction processing section 60 has two operational amplifiers 63 and resistance R2.

[0023] Moreover, in the digital digital disposal circuit 55, the direction and magnitude of a load are computed by compounding the vector of the output of each shaft orientations, and data processing which determines the migration direction and passing speed of cursor 51 from these is performed. Or after carrying out A-D conversion instead of this data processing, the simple approach of decomposing the vector of the processing like software, for example, the output of each shaft orientations, into a devices side, such as a computer, with the respectively required number of decomposition, making a matrix combination for several of those decomposition minutes, and making it into a two-dimensional direction and magnitude may be enforced.

[0024] Next, the input process when operating the detection principle of a pointing device and a pointing device is explained. If the ceiling part 35 of the movable object 20 is operated in the two-dimensional direction by the fingertip as shown in drawing 11 , moving part 26 will displace in the upper part [root / of the foot 30 supported to the fixed part 27], will be in the condition that moving part 26 inclined for a while, and change will produce it at the include angle of a reflector 36 and the optical axis of a tilt

sensor. Therefore, the light irradiated from the light emitting device 21 passes a lens 28, and it is reflected by the reflector 36 of moving part 26, it passes a lens 28 again, and image formation is carried out on a photo detector 22. At this time, the image of the light received by the photo detector 22 is moving before and after displacement of moving part 26.

[0025] Here, as shown in drawing 12 , the variation rate of a reflector 36 serves as rotation centering on the Y-axis which intersects perpendicularly with the shaft, i.e., the X-axis, and this with which a light emitting device 21 and a photo detector 22 are located in a line with the variation rate of moving part 26. From this, the direction of a load given by artificial actuation can be transposed to the 2-way of the hand of cut consisting mainly of the X-axis and a Y-axis, and input process can be performed. For example, the image of the light on a photo detector 22 moves to Y shaft orientations by rotation of the circumference of the X-axis shown in drawing 13 (a). Moreover, the image of the light on a photo detector 22 moves to X shaft orientations by rotation of the circumference of the Y-axis shown in drawing 13 (b).

[0026] The current value acquired with four photodiodes A, B, C, and D of a photo detector 22 is set to ISCA, ISCB, ISCC, and ISCD, respectively. And if electrical-potential-difference conversion of the output current of each photodiodes A, B, C, and D is carried out by the electrical-potential-difference transducer 58, it will be set to VA=R1xISCA, VB=R1xISCB, VC=R1xISCC, and VD=R1xISCD, respectively. Next, since the image of light moves to Y shaft orientations by the deflection of a reflector 36 to rotation of the circumference of the X-axis, it divides into 2 sets, Photodiodes A and C and Photodiodes B and D, and each output voltage is added. Similarly, to rotation of the circumference of a Y-axis, it divides into 2 sets, Photodiodes A and B and Photodiodes C and D, and each output voltage is added. Thereby, to rotation of the circumference of the X-axis, - (VA+VC) and - (VB+VD) are obtained as an output from the addition processing section 59, and - (VA+VB) and - (VC+VD) are obtained to rotation of the circumference of a Y-axis. And VY=(VA+VB)-(VC+VD) is obtained by the subtraction processing section 60 as a vector of the output of VX=(VA+VC)-(VB+VD) and Y shaft orientations as a vector of the output of X shaft orientations, respectively.

[0027] At this time, the relation between angle of rotation of the circumference of the X-axis and VX serves as a S character curve which has a linear output change as shown in drawing 14 . Similarly, the relation between angle of rotation of the circumference of a Y-axis and VY serves as a S character curve which has a linear output change as shown in drawing 15 . Therefore, in the linear output range of VX, VX is uniquely determined to X-axis angle of rotation, and VY is uniquely determined to Y-axis angle of rotation in the linear output range of VY. By rotation of the circumference of the X-axis, at the time of calculation of VX and VY, in addition, A and each photodiode of C, B, and D, Having added the output current of A and each photodiode of B, C, and D in rotation of the circumference of a Y-axis, respectively It is for enlarging light-receiving area which can be effectively used to the migration direction of the image of light, and also in order to absorb dispersion in the optical axis by assembly dispersion on real use, the above-mentioned addition processing becomes effective.

[0028] And if the output of VX and VY is obtained by the analog signal processing circuit 53, the load direction over the load added to the movable object 20 by the composition of vectors of a 2-way as shown in drawing 16 , and its magnitude will be called for. That is, it is theta=tan, when a direction is set to theta and magnitude is set to V. - 1 (VY/VX) (1)

V=VX/costheta=VY/sintheta =VX/cos (tan-1 (VY/VX))

=VY/sin(tan-1(VY/VX)) (2)

As mentioned above, if VX and VY can be found, Direction theta and magnitude V will be determined. And it asks for the migration direction and passing speed of cursor 51 based on theta and V which were determined. Therefore, by operating the movable object 20, an output is obtained corresponding to the actuation direction and control input, and cursor 51 can move only a desired distance towards desired in a display 50 by this. That is, if the load added to the movable object 20 is enlarged, cursor 51 will move in the added load direction with quick passing speed, and if a load is made small, it will move slowly. And if a finger is lifted from the movable object 20, migration of cursor 51 will stop.

[0029] Next, the result checked by the optical simulation (the ray-tracing approach) is shown in drawing

17 and 18 about VX obtained by the pointing device of this example and VY serving as a linear output change to each angle of rotation. The refractive index of the resin which discharges and uses 120 beams of light in a certain solid angle deltaomega in the point light source from a light emitting device 21, the curvature of a lens 28, etc. were inputted into the computer, simulation was carried out about each beam of light according to the principle of reflection and refraction, and this simulation estimated 120 duties which discharged the reinforcement of the beam of light which finally reaches to a photo detector 22. In the above technique, 120 were discharged, having used the strength of the beam of light per one as 100 the first stage (total reinforcement is 120x100=12000), and the results of an operation VX and VY of the reinforcement obtained by the axis of abscissa by the photo detector 22 in angle of rotation considering the reinforcement obtained by the photo detector 22 of a quadrisection photodiode as VX=(A+C)-(B+D) and VY=(A+B)-(C+D) are graph-ized. The S character curve of VX and VY is obtained also from this simulation result to change of an include angle, and it turns out that it is possible to change into the direction theta shown by the above-mentioned formula (1) and (2) and magnitude V by making a linear output change field into the use field as a pointing device. In addition, the offset gap is produced in the Y-axis hand of cut in this simulation result, because the physical relationship of the light emitting device 21 and photo detector 22 of Y shaft orientations has shifted from the optimal location, and it can ask for the optimal location by repeating simulation.

[0030] Thus, by constituting from a tilt sensor and a movable object which contains it as a pointing device, a miniaturization can be attained, installation to the space surrounded by each key of a keyboard is attained, and space-saving-ization of devices, such as a computer, can be attained. And since the non-contact optical method is used, the mechanical operation section does not exist, but high-reliability is acquired, and it can be equal to prolonged use. Moreover, since the variation rate of all the two-dimensional directions is detectable in analog, input process can be performed easily. Therefore, software for input process can be made easy and, on the whole, the cheap pointing device of cost can be offered.

[0031] By the way, while the devices 23, such as a computer, turn on and being able to attain low consumed-electric-current-ization if a light emitting device 21 is driven so that light may be emitted intermittently, and the output current from a photo detector 22 is detected according to this timing instead of making a light emitting device 21 always emit light since alter operation by the pointing device is not necessarily always performed, the effect of disturbance, such as a noise, can also be eliminated and dependability can be raised.

[0032] (The second example) this example -- like drawing 19 and 20 -- as a photo detector -- instead of [of a quadrisection photodiode] -- two-dimensional -- PSD(semi-conductor location sensing element) 70 is used. This PSD70 is an amelioration surface assembled die, and the top face of the envelope equipped with the terminal for taking out the output current is equipped with an aperture, in order to change incident light into an electrical signal inside, it is having structure where the semi-conductor with which the PN-junction side was formed was attached, and four electrodes 71 are formed in a front-face side, and the common electrode is prepared in the rear-face side. In addition, other structures of a tilt sensor and other configurations are the same as the first example.

[0033] And it is condensed with a lens 28 and the light which it irradiated from the light emitting device 21, and was reflected in the reflector of the movable object 20 reaches PSD70. If the spot light P carries out incidence to PSD70, the charge proportional to light energy will be generated in an incidence location, and this charge will be outputted from each electrode 71 as a current. It can ask for the incidence location of light according to the output current from each electrode 71.

[0034] Here, the relation of the current acquired from the incidence location and electrode 71 of the spot light P of PSD70 comes to be shown below in drawing 21 (a).

[0035] I1+I2=I0(1/2-X/LX)
I3+I4=I0(1/2+X/LX)
I2+I3=I0(1/2-Y/LY)
I1+I4=I0(1/2+Y/LY)
I0: All currents (I0=I1+I2+I3+I4)

I1: current I2: in an electrode 1 -- current I3: in an electrode 2 -- current I4: in an electrode 3 -- light-receiving side die-length X: on the light-receiving side die-length LY:Y-axis on the current LX:X-axis in an electrode 4, when an axis of coordinates is taken centering on a light-receiving side X coordinateY: of a ****** location -- the Y coordinate of the incidence location when taking an axis of coordinates centering on a light-receiving side -- from these the incidence location of X shaft orientations (I1+I2) / (I1+I2+I3+I4) =1/2-X/LX Or the incidence location of (-(I1+I2))/(I1+I2+I3+I4) =2 X/LXY shaft orientations [(I3+I4)] It becomes (I2+I3) / (I1+I2+I3+I4) =1/2-Y/LY, or ((I1+I4)-(I2+I3))/ (I1+I2+I3+I4) =2 Y/LY.

[0036] As mentioned above, the vector of X shaft orientations and Y shaft orientations is acquired, and magnitude root (X2+Y2) and Direction theta can be searched for like drawing 21 (b). Therefore, even if it uses PSD70, migration control of cursor 51 can be performed, and the same operation effectiveness as the first example can be done so.

[0037] (The third example) In this example, using four photodiodes E, F, G, and H as a photo detector 22, like drawing 22 , four photodiodes E, F, G, and H are arranged so that the perimeter of a light emitting device 21 may be surrounded on the X-axis centering on the light emitting device 21 which is LED, and a Y-axis. The interior of a light emitting device 21 and each photodiodes E, F, G, and H is carried out to the electrode holder which is not illustrated, it is carried in a lead terminal, respectively, and mold is carried out with translucency resin, and it is shaded between a light emitting device 21 and Photodiodes E, F, G, and H so that light may not carry out incidence to the direct photodiodes E, F, G, and H from a light emitting device 21. And a lens 28 is attached above an electrode holder and a tilt sensor is constituted.

[0038] Moreover, although other configurations are the same as the first example, the configurations of the analog signal processing circuit 53 differ. Namely, the electrical-potential-difference transducer 75 which carries out electrical-potential-difference conversion of the output current from each photodiodes E, F, G, and H like drawing 23 , It consists of 2 sets of predetermined photodiodes E, F, and G, and the subtraction processing section 76 which subtracts the output voltage of H and calculates the output of X shaft orientations and Y shaft orientations. The electrical-potential-difference transducer 75 has the operational amplifier 77 and resistance R1 corresponding to each photodiodes E, F, G, and H, and the subtraction processing section 76 has two operational amplifiers 78 and resistance R2.

[0039] In such a configuration, if the ceiling part 35 of the movable object 20 is operated in the two-dimensional direction by the fingertip, moving part 26 will displace and the image of the light received by Photodiodes E, F, G, and H as a result will move it before and after displacement of moving part 26. That is, the variation rate of a reflector serves as rotation centering on the Y-axis which intersects perpendicularly with the shaft, i.e., the X-axis, and this with which a light emitting device 21 and a photo detector 22 are located in a line with the variation rate of moving part 26. For example, Photodiodes E, F, and G and the image of the light on H move to Y shaft orientations by rotation of the circumference of the X-axis shown in drawing 24 (a). Moreover, Photodiodes E, F, and G and the image of the light on H move to X shaft orientations by rotation of the circumference of the Y-axis shown in drawing 24 (b). And the value of the output current from each photodiodes E, F, G, and H changes with locations of the image of light, and VY=VG-VH is obtained from the difference of the output current of Photodiodes E and F from the difference of the output current of Photodiodes G and H as a vector of an output to VX=VE-VF and Y shaft orientations to X shaft orientations as a vector of an output.

[0040] At this time, the relation between angle of rotation of the circumference of the X-axis and VX serves as a S character curve which has a linear output change as shown in drawing 25 (a). Similarly, the relation between angle of rotation of the circumference of a Y-axis and VY serves as a S character curve which has a linear output change as shown in drawing 25 (b). Therefore, VX is uniquely determined to X-axis angle of rotation, and VY is uniquely determined to Y-axis angle of rotation. And if the output of VX and VY is obtained by the analog signal processing circuit 53, the load direction theta over the load added to the movable object 20 by the composition of vectors of a 2-way as the digital digital disposal circuit 55 was shown in drawing 25 (c), and its magnitude V will be called for. As mentioned above, since Direction theta and magnitude V can be determined, it can ask for the migration direction and

passing speed of cursor 51 based on this theta and V, and cursor 51 can move only a desired distance towards desired in a display 50. Like the above, the same operation effectiveness as the first example can be done so also in this example.

[0041] (The fourth example) In the above-mentioned example, the tilt sensor combined the light emitting device 21, the photo detector 22, and the lens 28. Since LED is used for a light emitting device 21 and the light from LED spreads, since it condenses, a lens 28 is needed, and there is evil in which components mark increase. So, in this example, the tilt sensor of the simple structure which made the lens unnecessary is used. That is, the hologram lens 80 is formed in the ceiling part inferior surface of tongue of moving part 26 like drawing 26 . In addition, other configurations are the same as the first example, and do the same operation effectiveness so.

[0042] Although the role of a reflecting plate and a lens is played, the light irradiated from LED which is a light emitting device 21 spreads and the hologram lens 80 reaches the hologram lens 80, if reflected by the hologram lens 80, it will converge toward a photo detector 22 and incidence will be carried out on a photo detector 22. Thus, since a lens is omissible, a tilt sensor can be miniaturized and the miniaturization of the pointing device itself can be attained in connection with it.

[0043] Moreover, since what is necessary is to be able to lose a lens completely since converge light and it is not diffused, and to form only a reflector 36 in the movable object 20 moreover, if semiconductor laser 81 is used instead of LED as a light emitting device 21 like drawing 27 , structure of a pointing device can be simplified further. In addition, other configurations are the same as the first example, and do the same operation effectiveness so.

[0044] (The fifth example) In this example, like drawing 28 , the light emitting device 21 was prepared for the moving part 26 of the movable object 20, the light emitting device 21 was made to counter and the photo detector 22 is formed. The interior of the photo detector 22 is carried out to the electrode holder 85 fabricated with protection-from-light nature resin, and it is carried in the substrate 86 fixed to the base of an electrode holder 85. A fixed part 27 is equipped with an electrode holder 86, and the circular pinhole 87 which passes light is formed in the top face of an electrode holder 85. And it is carried in the substrate 88 with which the light emitting device 21 was fixed to the ceiling part 35 of moving part 26 [above an electrode holder 85], the variation rate of moving part 26 is interlocked with, and a light emitting device 21 is also displaced. In addition, it is LED, a photo detector 22 is a quadrisection photodiode, and the structure of the movable object 20 of a light emitting device 21 is the same as the first example.

[0045] According to this configuration, the light irradiated from the light emitting device 21 passes through a pinhole 87, a photo detector 22 is reached, but like drawing 29 , the variation rate of moving part 26 is interlocked with, a light emitting device 21 is also displaced, the variation rate of that light emitting device 21 is equal to the variation rate of moving part 26, and the image of light displaces it on a photo detector 22. At this time, the direction of the variation rate of moving part 26 and the displacement direction of the image of light become the reverse sense 180 degrees. In addition, each physical relationship of a light emitting device 21, a photo detector 22, and a pinhole 87 can adjust the variation rate. And amount of displacement deltaL (carrier) of the image of the light on a photo detector 22 is as follows.

[0046] deltaL(carrier) =deltaL(shot) xd1/d2deltaL(shot): -- the variation rate of a light emitting device 21 -- amount d1: -- distance d2: of the top face of an electrode holder 85, and a photo detector 22 -- the distance of the top face of an electrode holder 85, and a light emitting device 21 -- corresponding to the variation rate of moving part 26, the output current of each photodiodes A, B, C, and D is acquired in this way. According to the signal-processing approach shown in the first example after that, the vector of the output of X shaft orientations and Y shaft orientations is searched for, the actuation direction and control input to the movable object 20 calculate, and migration control of cursor 51 is performed. Therefore, that there should just be a tooth space which with such structure it becomes unnecessary to arrange a light emitting device 21 and a photo detector 22 side by side, and can arrange only one component, since the movable object 20 can be made thin, a pointing device can be miniaturized further.

[0047] Moreover, instead of arranging the direct light emitting device 21 to moving part 26, like drawing 30 , a light emitting device 21 may be arranged to a fixed part 27, and the lightguide 90 which leads the light from a light emitting device 21 to the ceiling part 35 of moving part 26 may be formed in the interior of moving part 26. As lightguide 90, the optical fiber made of synthetic resin is really fabricated with moving part 26 with embedding at the time of shaping of moving part 26 ****, or translucency resin. According to this, while being able to make the movable object 20 thin, the dimension of the height direction can also be shortened and serves as a small pointing device.
[0048] (The sixth example) from the fixed part 96 elastically supported like drawing 31 and 32 in this example so that it might dissociate from the devices 23, such as a computer, the movable object 20 may be arranged and the movable object 20 may tilt the dome-like moving part 95 and moving part 95 by artificial actuation -- becoming -- a palm -- it is the mouse configuration which can be operated in size, and connects with the devices 23, such as a computer, through the connector. And it is equipped with the tilt sensor which made the light emitting device 21, the photo detector 22, and the lens 28 in one in the center of a top face of a fixed part 96, and moving part 95 is allotted so that the upper part of a tilt sensor may be covered. Moving part 95 is formed in the shape of a reverse bowl, and it is inserted in the slot 97 where the lower limit was formed in the periphery of the top face of a fixed part 96, and it is attached free [tilting] so that it may be united with a fixed part 96 with the elastic members 98, such as a spring or rubber. Moreover, the tilt sensor of moving part 95 and the field which counters are made into a flat surface, surface treatment for mirror-plane-izing here is performed, and the reflector 99 is formed. In addition, the structure and the input-process approach of a tilt sensor are the same as the first example. moreover, not only a configuration like a mouse as a configuration of a movable object but a palm -- you may make it the stereo of the polygon of the magnitude of extent.
[0049] If it has so that with the above structures the movable object 20 may be put on the location of arbitration and moving part 95 may be wrapped in a palm, and a palm is moved in front and rear, right and left and the two-dimensional direction, moving part 95 can incline, a reflector 99 can incline in connection with this, and a tilt sensor can detect the variation rate of moving part 95. Therefore, since the movable object 20 can be operated in the palm, it has operability equivalent to a mouse, it can become unnecessary to move a flat-surface top like a mouse further, it can become operational in the condition of having installed in the location of arbitration, space-saving-ization can be attained, and facility can be investigated regardless of the condition of an installation. Moreover, unlike a mouse, there is no mechanical operation section, and it excels also in the point of dependability compared with pointing devices, such as a mouse of the former also in cost.
[0050] In addition, as for this invention, it is needless to say that it is not limited to the above-mentioned example and many corrections and modification can be added to the above-mentioned example within the limits of this invention. For example, although the fixed part 27 and moving part 26 of the movable object 20 fabricated with the heterogeneous ingredient, respectively, by filling the degree of hardness and bending elastic modulus to the rigid body or an elastic body with the same ingredient, they may fabricate a fixed part 27 and moving part 26 with the same ingredient, and can reduce ingredient cost compared with the case where a heterogeneous ingredient is used. Moreover, you may fabricate, respectively so that it may become an elastic body about a fixed part 27 and may become the rigid body about moving part 26. Furthermore, in order to carry out the variation rate of the movable object 20, it is [that the part which starts from the fixed part 27 of moving part 26 should just be an elastic body] good to fabricate only this part by elastic resin. Moreover, in the fifth example, even if reverse in arrangement of a photo detector 22 and a light emitting device 21, it is good.
[0051] Furthermore, it is possible it not only to install a pointing device between the keys of a keyboard, but to use it as an object for navigation systems which requires substitution, or the switch and direction directions of the joy stick of a computer-game machine or a mouse, installing in another tooth spaces other than a keyboard. And it is applicable also to the application which performs the communication link with the body of a computer through a connector like a mouse.
[0052]
[Effect of the Invention] According to this invention a passage clear from the above explanation, by

making a movable object and a detection object the configuration made into one, a miniaturization can be attained, installation to the space surrounded by each key of a keyboard is attained, and it can contribute to space-saving-ization of devices, such as a computer. Moreover, since there is no mechanical operation section by considering as a non-contact optical method, while there is no change in detection precision and being able to offer a pointing device with high dependability, input process can be performed simply and the pointing device which cost does not apply synthetically can be realized.

[0053] A variation rate can be certainly carried out to the load added to the movable object, and an input as meant can be made to perform by using either moving part or a fixed part as the rigid body, and using another side as an elastic body using an ingredient or an ingredient of a different kind of the same kind.

[0054] Since the light from a light emitting device can be used effectively, the output of a detection object becomes large and a sharp image is moreover obtained by making the photo detector of a movable object, and the field which counters into a reflector, and performing surface treatment, a detection property can be raised.

[0055] By preparing either a light emitting device or a photo detector in a movable object, countering a movable object and preparing another side, installation area can be lessened compared with the case where a light emitting device and a photo detector are arranged side by side horizontally, and space-saving-ization can be attained further.

[0056] Since it has suitable magnitude when it considers as operational size, and a movable object dissociates from devices, such as a computer, and arranges by a palm etc., and operability needs to be good, and needs to be made to a device and another objects, such as a computer, can contribute also to space-saving-ization of a device and it is not necessary to make it move compared with a mouse further, an installation cannot be chosen but usability can also be raised.

[0057] Moreover, by adopting an optical method as the detection approach of a variation rate, in a software side, the art of an output signal becomes easy and can plan synthetic cost reduction.

[Translation done.]

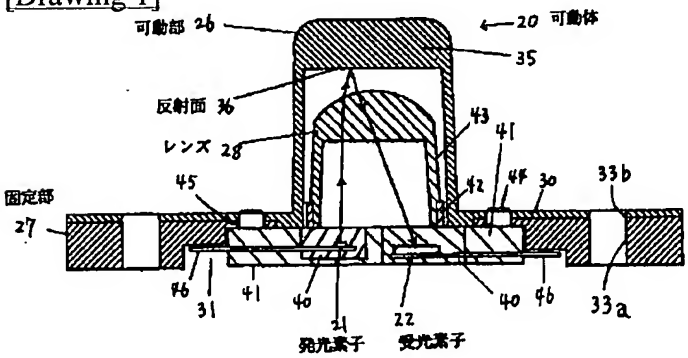
* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

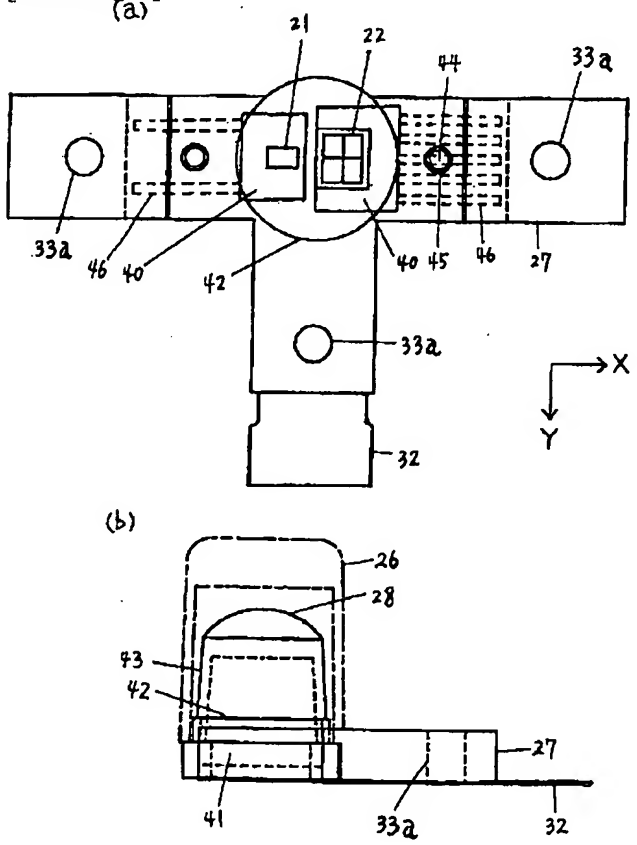
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

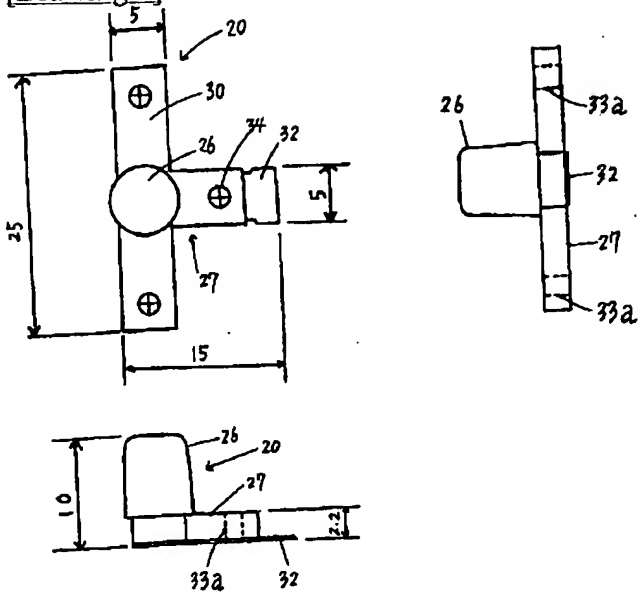
[Drawing 1]



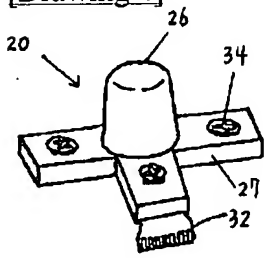
[Drawing 2]



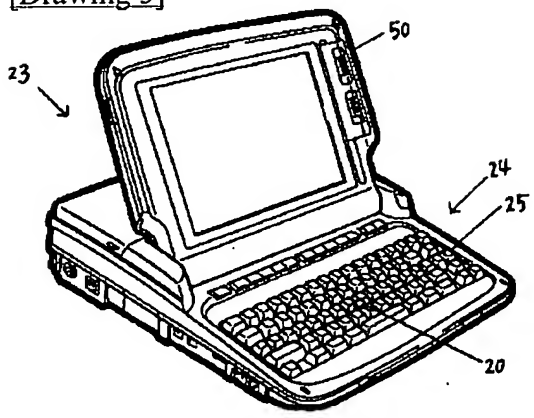
[Drawing 3]



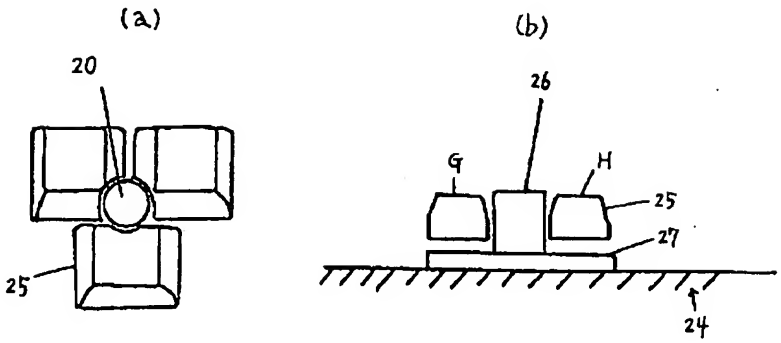
[Drawing 4]



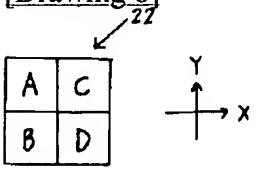
[Drawing 5]



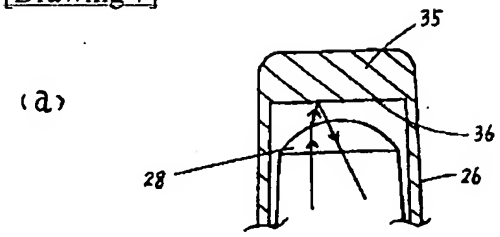
[Drawing 6]

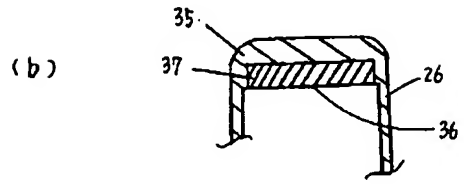


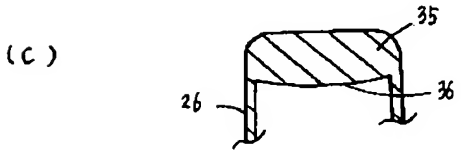
[Drawing 8]



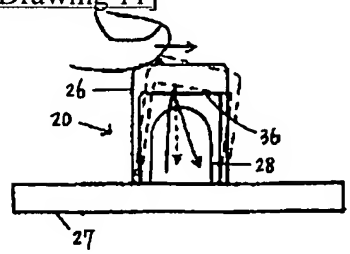
[Drawing 7]



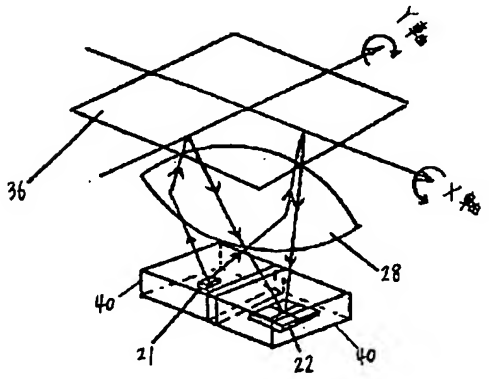




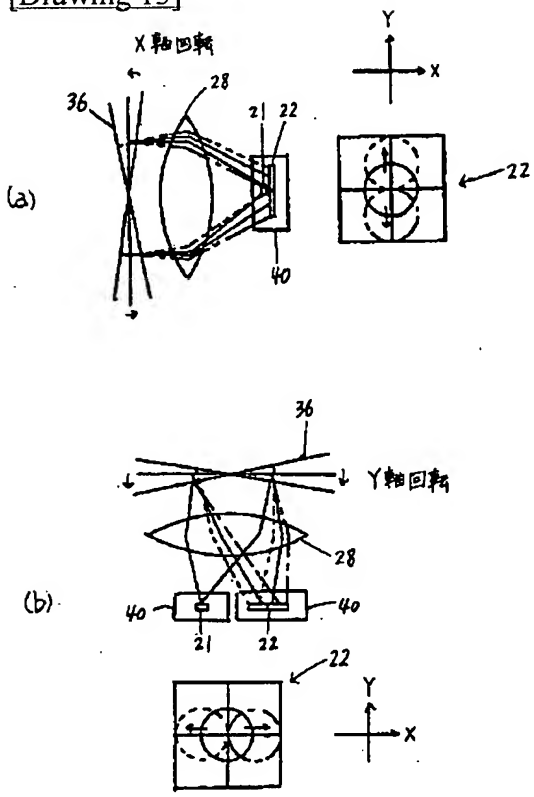
[Drawing 11]



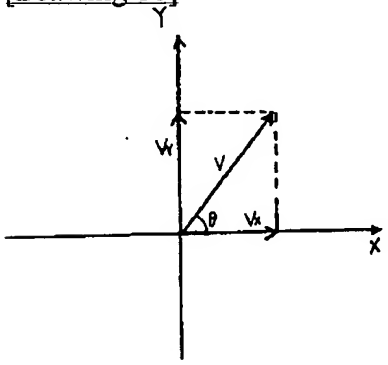
[Drawing 12]



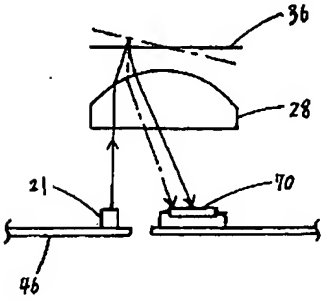
[Drawing 13]



[Drawing 16]

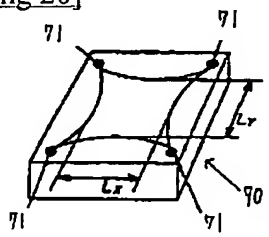


[Drawing 19]

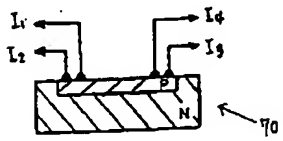


[Drawing 20]

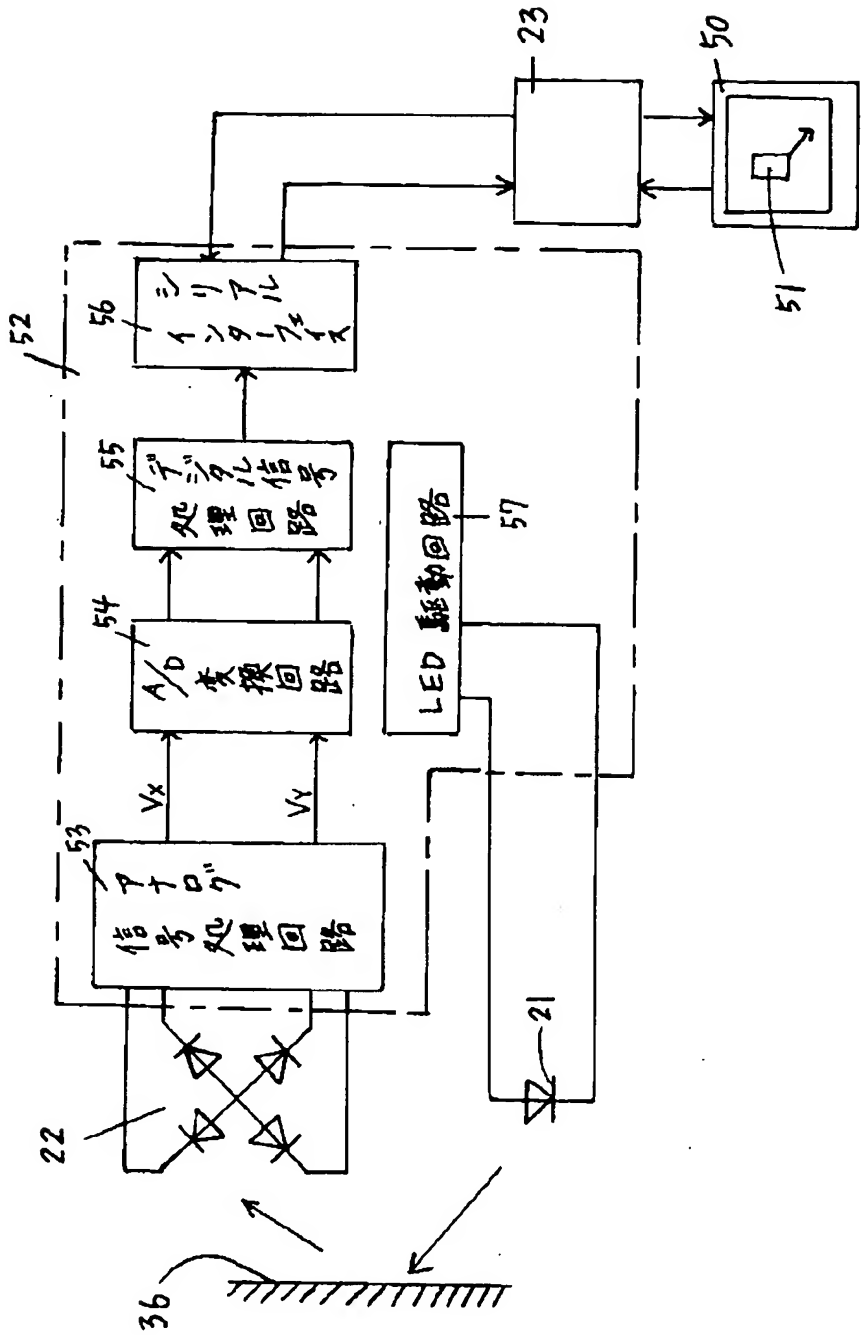
(a)



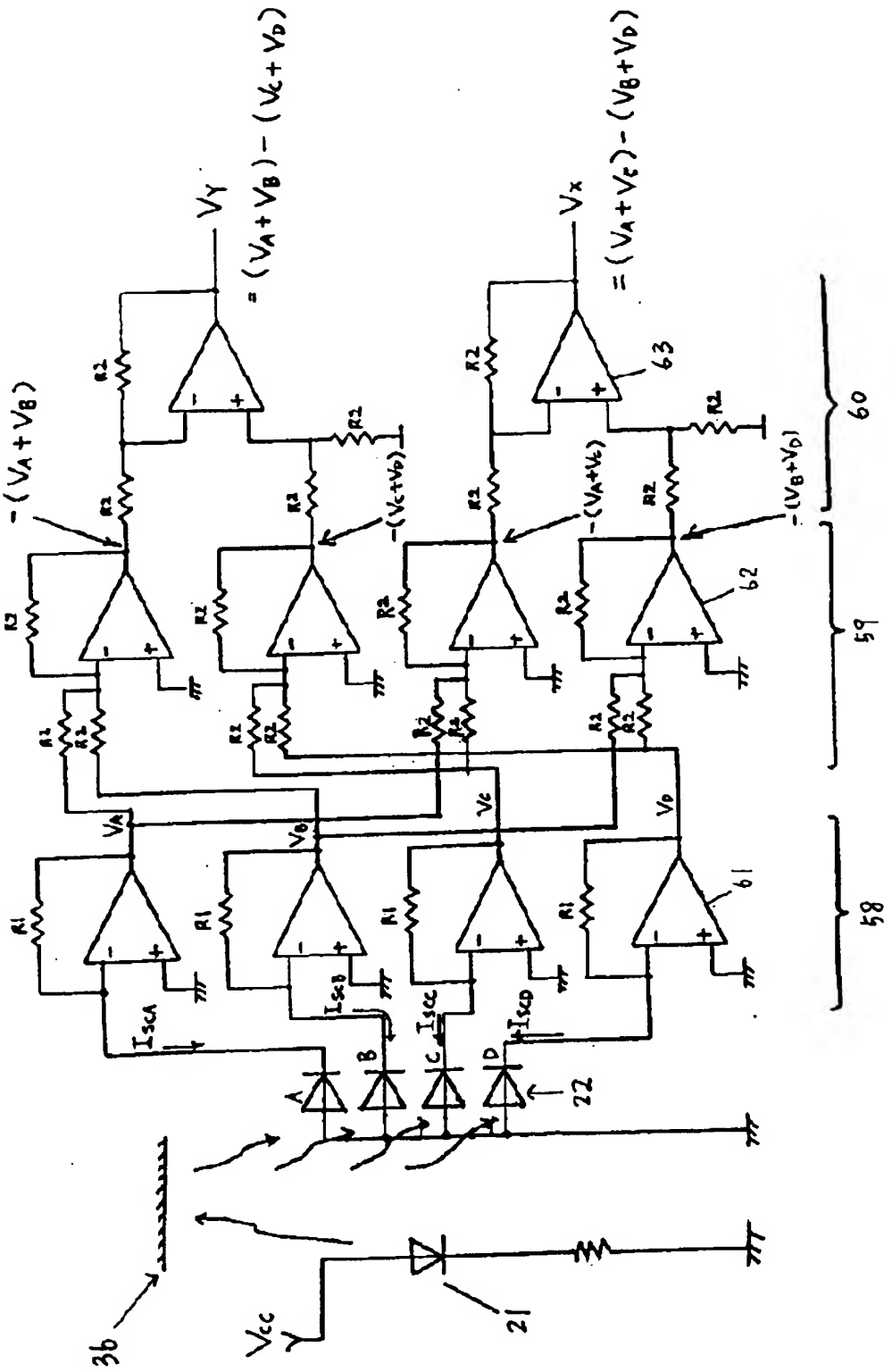
(b)



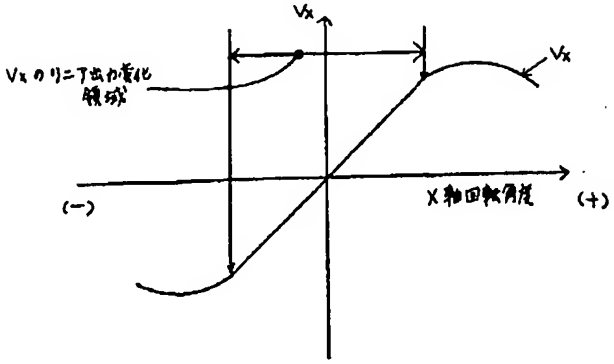
[Drawing 9]



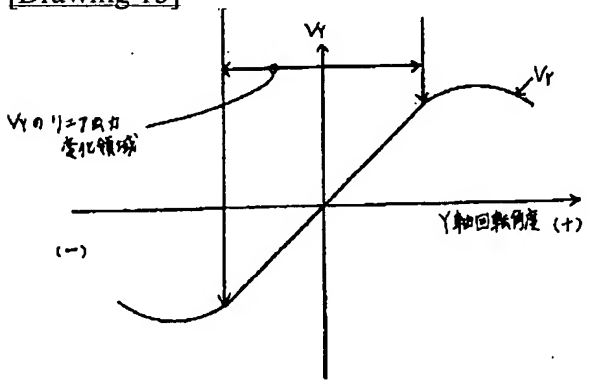
[Drawing 10]


Vy
= (VA+VB) - (Vc+VD)
Vx
= (VA+Vc) - (VB+VD)
-(VA+VB)
-(Vc+VD)
-(VA+Vc)
-(VB+VD)
R1
R2
63
62
61
60
59
58
VA
VB
Vc
VD
ISCA
ISCB
ISCC
ISCD
A
B
C
D
22
21
3b
Vcc
Y

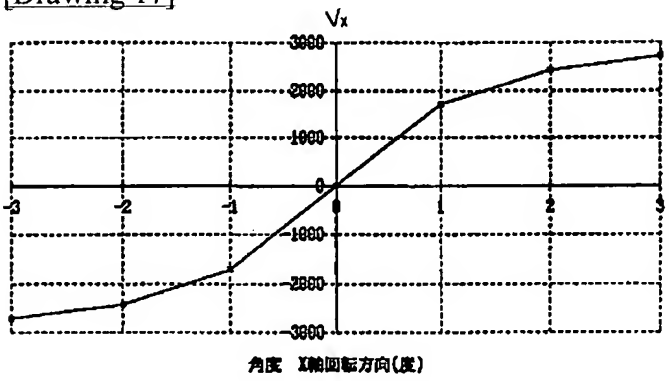
[Drawing 14]



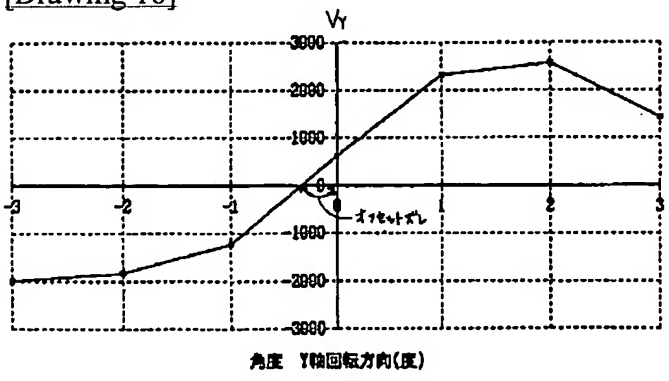
[Drawing 15]



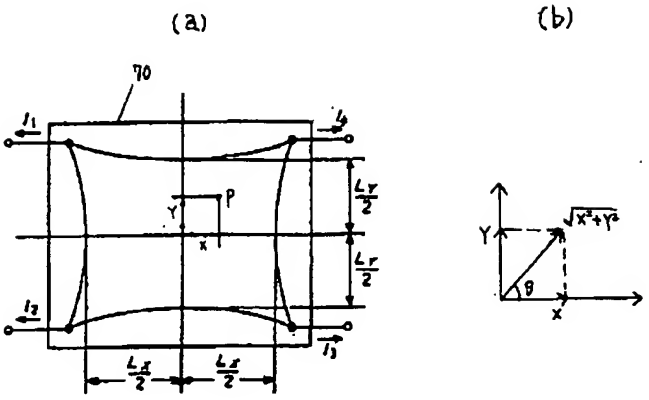
[Drawing 17]



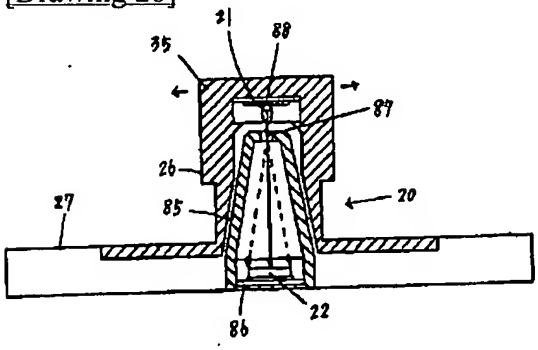
[Drawing 18]



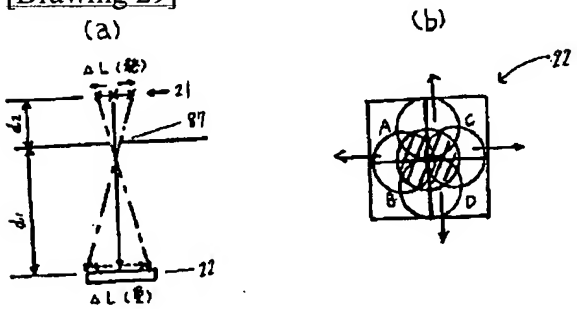
[Drawing 21]



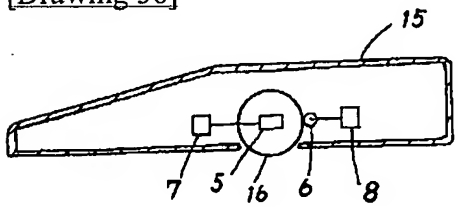
[Drawing 28]



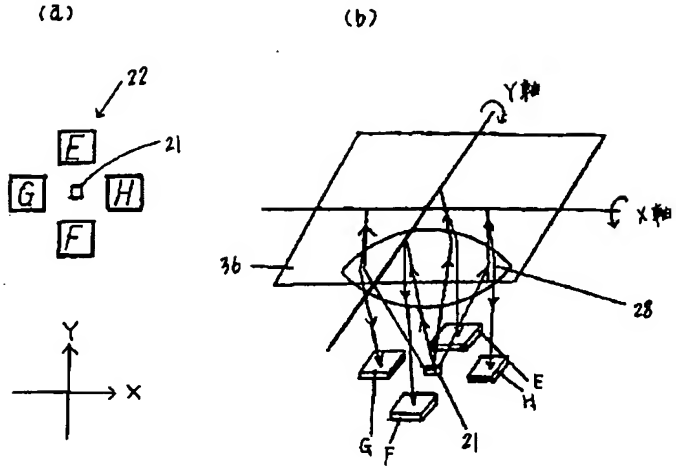
[Drawing 29]



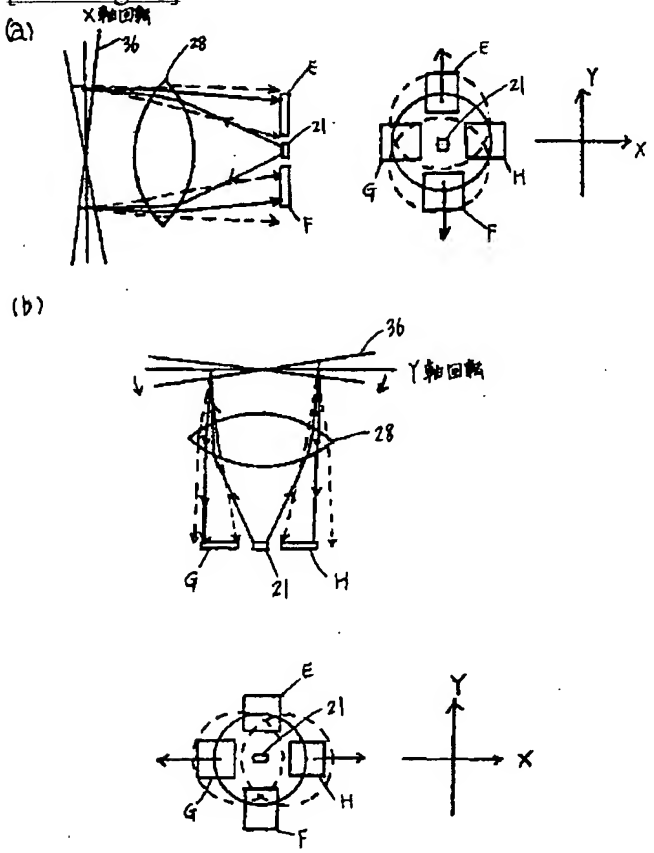
[Drawing 36]



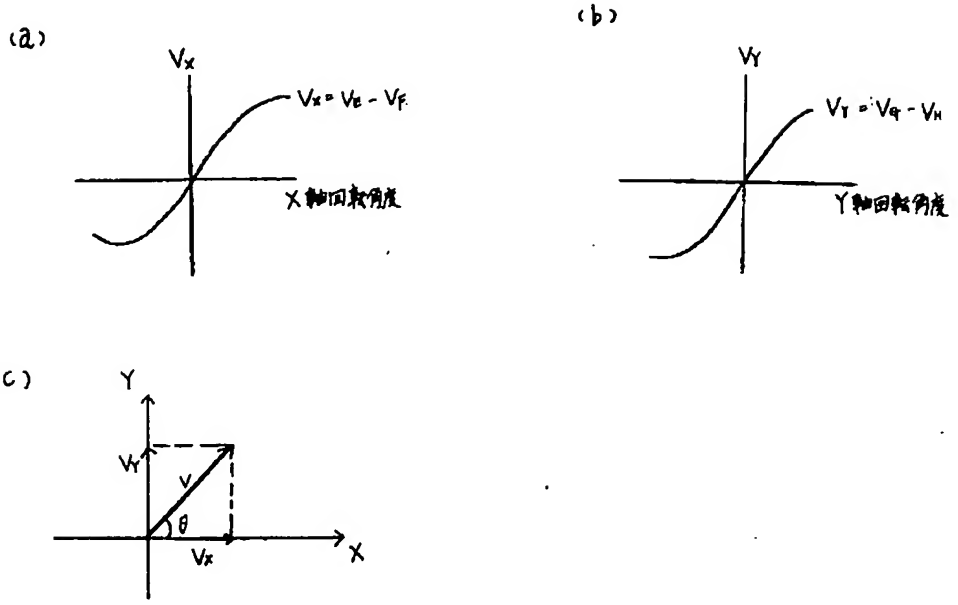
[Drawing 22]



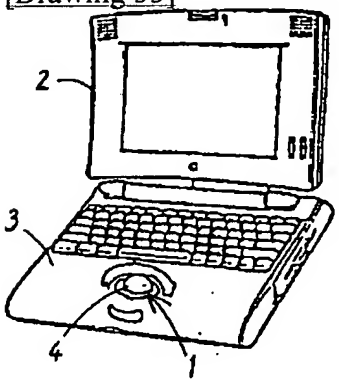
[Drawing 24]



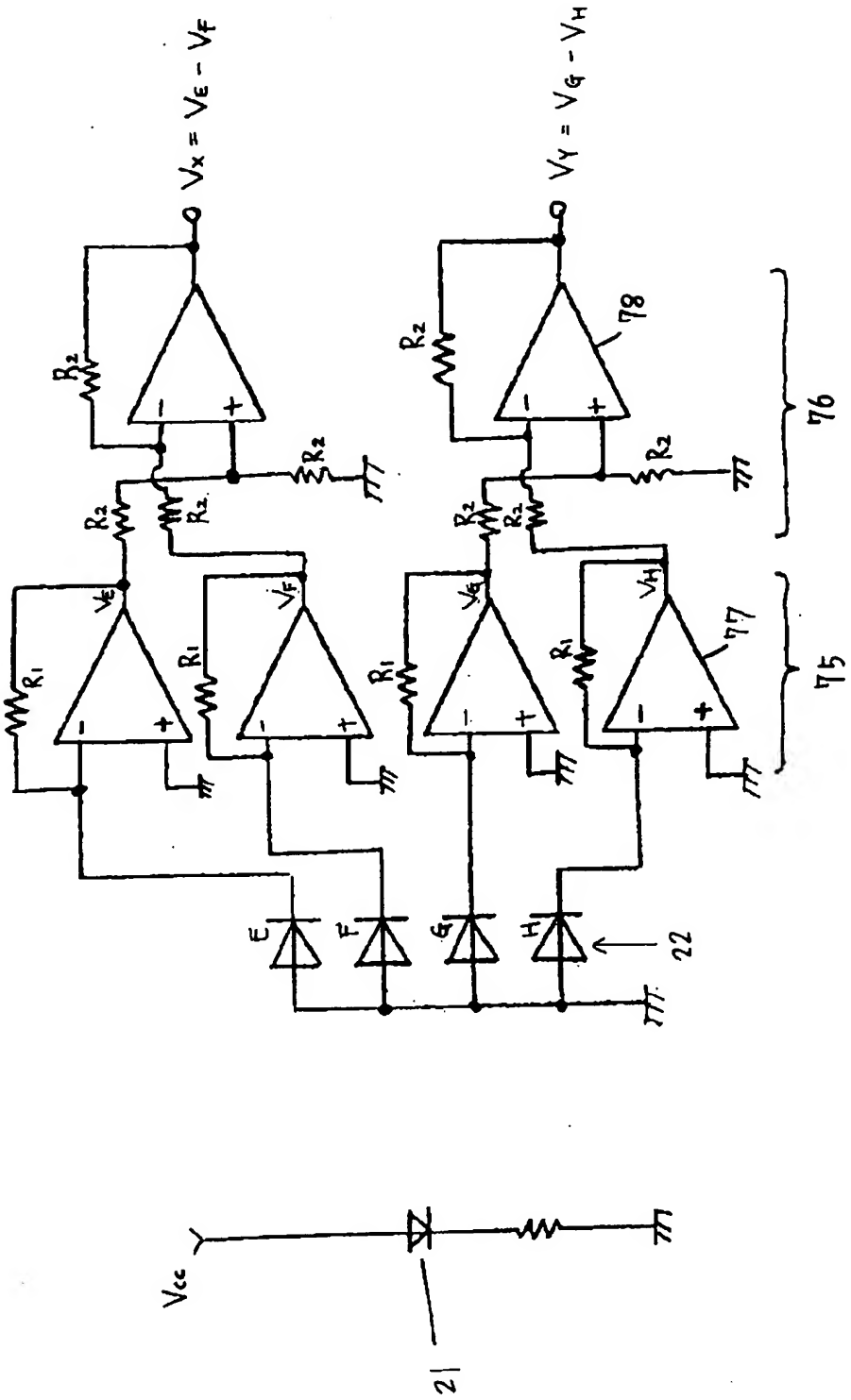
[Drawing 25]



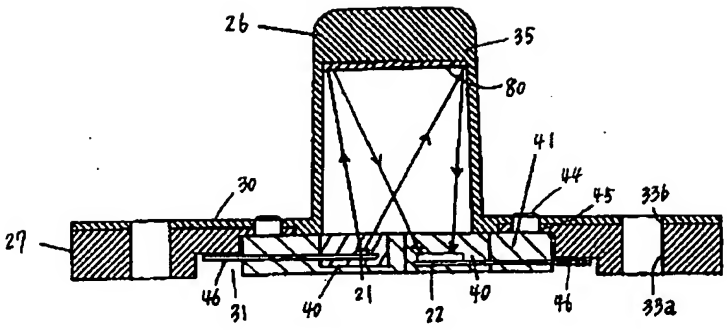
[Drawing 33]



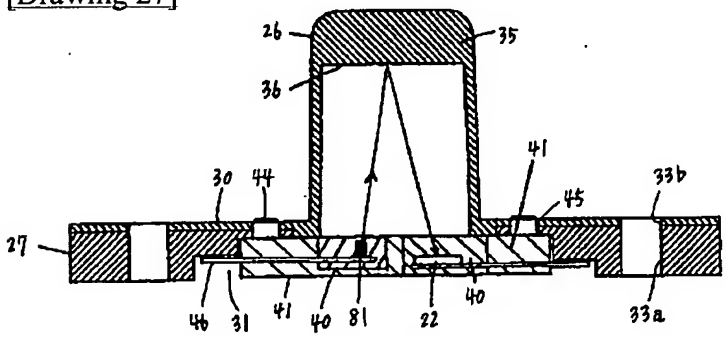
[Drawing 23]



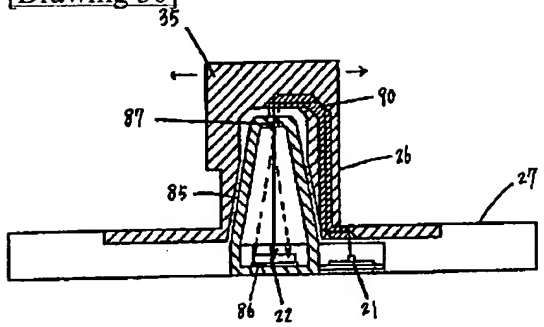
[Drawing 26]



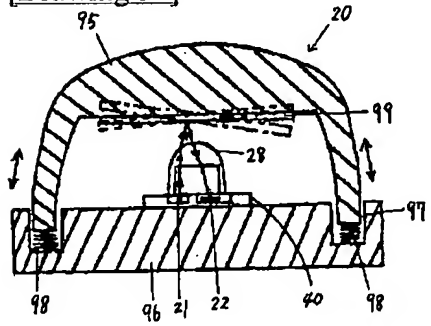
[Drawing 27]



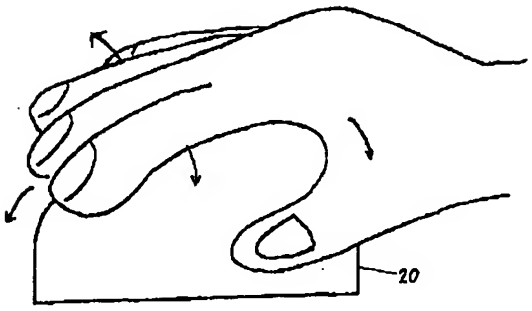
[Drawing 30]



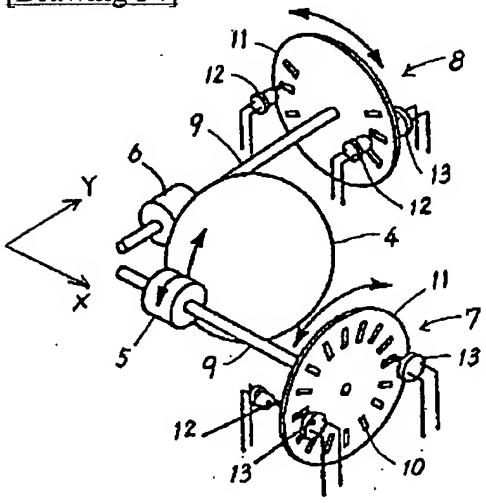
[Drawing 31]



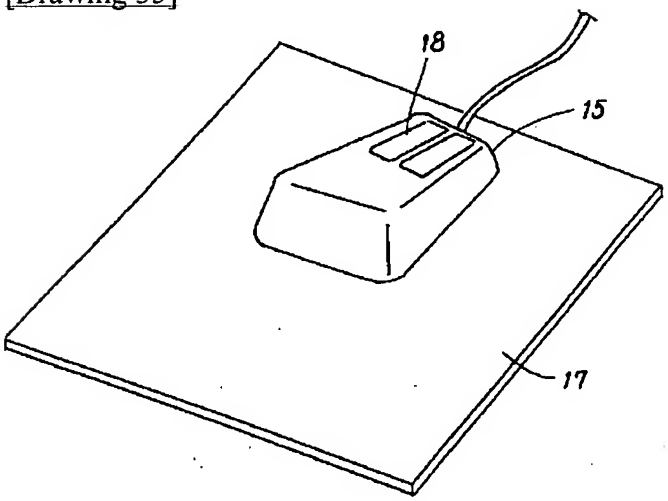
[Drawing 32]



[Drawing 34]



[Drawing 35]



[Translation done.]